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FEDERAL COMMUNICATIONS COMMISSION
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March 15, 1994

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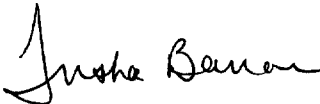
Re: *ET Docket No. 93-61*

Dear Mr. Caton:

On behalf of PacTel Corporation, please find enclosed an original and six copies of its "*Comments*" in the above proceeding.

Please stamp and return the provided copy to confirm your receipt. Please contact me should you have any questions or require additional information concerning this matter.

Sincerely,



for Kathleen Q. Abernathy

Enclosures

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MAR 15 1994

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of)
)
Amendment of Part 90) PR Docket No. 93-61
of the Commission's Rules) RM-8013
to Adopt Regulations)
for Automatic Vehicle)
Monitoring Systems)

COMMENTS OF PACTEL TELETRAC

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SUMMARY

PacTel Teletrac has offered a compromise proposal in the 902-928 MHz band which would require two wideband LMS systems to share 10 MHz of spectrum, between 902-912 MHz. This approach would better accommodate narrowband LMS systems by providing 16 MHz of contiguous spectrum over which to operate on a co-primary basis, and would also improve the environment for Part 15 devices which operate throughout the band.

Teletrac's new proposal requires the Commission to adopt minimum sharing rules for wideband LMS systems, to provide sufficient certainty to allow widespread deployment of these services without limiting innovation and flexibility. These rules consist of time synchronization for "housekeeping" transmissions in the return (mobile-to-base station) link. Forward link signals would be allocated separate spectrum to avoid service degradation. The first two wideband LMS systems to construct and operate would receive co-channel protection.

Telerac's sharing proposal is technically feasible and offers the best solution to the competing demands for this spectrum.

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COMMENTS OF PACTEL TELETRAC

PacTel Teletrac ("Teletrac") is filing these comments in response to the Commission's Public Notice issued February 9, 1994.

I. Introduction

Teletrac is a joint venture between North American Teletrac and Location Technologies, Inc. It is the nation's leading provider of vehicle location services and was the initiator of this proceeding. Teletrac has an urgent interest in having permanent rules adopted for Location Monitoring Services ("LMS") systems because certainty is needed to encourage further development of such services.

Teletrac offered its new, compromise proposal in an ex parte filing on January 26, 1994 in an effort to accommodate competing demands for the 902-928 MHz spectrum and to speed the adoption of final rules for services in this band. The record developed in this proceeding reveals widely divergent

views of competing users or potential users of this spectrum. Not surprisingly, Teletrac still far prefers the 2-8-6-8-2 MHz band segmentation proposed by the Commission in its Notice of Proposed Rulemaking ("NPRM"), which would provide segregated spectrum for two wideband LMS systems.¹ The Commission apparently has continued to search, however, for an alternative in which two constructed wide-band LMS systems could share the same spectrum in the same market.²

Teletrac's revised approach, which requires sharing between two wideband LMS systems, is less satisfactory overall to Teletrac because it limits the capacity, reduces the capabilities, and impacts the accuracy of such systems. Nonetheless, it offers a viable option for commercial deployment of competing wideband LMS systems on a shared basis, without harmful interference to primary government services and Industrial, Scientific, and Medical (ISM) devices. As redesigned, the new spectrum plan will better accommodate alternative users of the spectrum, such as narrowband location systems, which would have 16 MHz of contiguous spectrum, and will also improve the sharing environment for Part 15 devices over the whole band by reducing the amount of spectrum available to co-channel protected wideband LMS systems.

¹ Notice of Proposed Rulemaking, FCC 93-141, released April 9, 1993.

² See, e.g., Letter from Chairman James H. Quello to Congressman Jack Fields, undated, sent in response to joint Congressional letter of September 14, 1993 regarding suggested principles for this proceeding.

Under Teletrac's sharing scheme, two wideband LMS systems would share 6.5 MHz for mobile-to-base-station transmissions (i.e., return link) on a co-primary basis, with no prescription as to technology to be utilized. Because neither system would have exclusive use of return link spectrum, each will have to tolerate interference and congestion from the competing system in the band. Subject to the other conditions of its proposal, Teletrac believes that service quality will be acceptable. The conditions include separate forward link spectrum, secondary status for narrowband systems (subject to grandfathering rules), and a requirement that additional wideband operators desiring to utilize the band prove noninterference with the first two systems.

The ability of two wideband systems to share spectrum requires the Commission to adopt sharing rules which will enable otherwise incompatible systems to coexist. These rules should provide the minimum structure necessary to permit competing systems to thrive, yet allow maximum diversity and competition in system design and innovation.

The essential requirement needed in Teletrac's sharing scheme is that calibration and synchronization signals occurring within the shared portion of the spectrum be time coordinated. These "housekeeping" functions, within the return link, must be strictly confined because they result in very high signal levels which would degrade overlapping mobile signals on the same channel. Absent rules for

sharing, each system would have to tolerate unpredictable disruptions to service that could be caused by these signals.

This loose sharing framework is sufficient to assure prospective system operators of a known operating environment in all potential markets, thus facilitating the ability of customers to use equipment in multiple markets. Additionally, manufacturers can reach economies of scale for system operators interested in deploying uniform equipment in several markets.

II. Highlights of Teletrac's Sharing Proposal

A. Two wideband LMS systems share 10 MHz of the 902-928 MHz band. 9.5 MHz of contiguous spectrum is allocated between 902.5 and 912 MHz, with 6.5 MHz of this spectrum being shared between the systems (904 to 910.5 MHz). The remainder (3 MHz) is divided equally between the two systems (902.5-904 MHz for System 2 and 910.5-912 MHz for System 1) for discretionary use for a wideband forward link, narrowband forward channels or additional return link bandwidth.

Forward link bandwidth must be allocated outside of the return link spectrum to prevent unacceptable degradation to system performance. Teletrac proposes that a narrowband link (250 kHz) per system be made available at 924.89-925.39 MHz. If this spectrum allocation is not made for future wideband LMS systems, at a minimum current systems utilizing such spectrum should be grandfathered to prevent stranded

investment and wasteful reengineering of tens of thousands of vehicle location units. To offset this proposed 500 kHz segment, a 500 kHz segment between 902-902.5 MHz is made available for upper band systems requiring narrowband forward channel utilization.

B. Teletrac is not proposing complex time sharing or system utilization rules, other than the mechanism needed to control any high power "housekeeping" transmissions.

Sharing of the spectrum is accomplished by exploiting the statistical nature of channel activity in the return link. Interference effects are mitigated by the spatial separation of transmitting units, the inherent receiver diversity associated with wide area LMS systems, and the processing gain provided by the ranging signals. Teletrac continues to believe that rigid time sharing rules would be inefficient, burdensome to enforce, and contrary to the public interest.³

Time synchronization for housekeeping transmissions would be accomplished using the Global Positioning Satellite (GPS) system. The first 50 ms of every odd second (GPS time) would be devoted to System One housekeeping, and the first 50 ms of the even seconds would be devoted to System Two housekeeping. One system may at its discretion use the

³ See Teletrac NPRM Comments, Appendix 1 ("Pickholtz Analysis") at 30-34. See also SBMS ex parte Letter from Robert L. Hoggarth to William F. Caton dated February 2, 1994 attaching AVM Systems Report by Virginia Tech Mobile and Portable Radio Research Group ("Virginia Tech Report") MobileVision reiterates its view that time division sharing will not work, but clearly misunderstood Teletrac's proposal in its description that the "location band be shared on a one (1) second time sharing basis." MobileVision ex parte at 4.

other's "assigned" housekeeping time for mobile transmissions, but at the risk of suffering interference from the housekeeping functions. Housekeeping signals from fixed transmitters should be limited to 1% of total system time (averaged over any minute), to preserve adequate capacity for mobile pulsed signals.⁴

C. Co-channel protection would be granted to the first two systems to construct and operate in a service area.

Teletrac believes that no more than two wideband LMS systems can coexist in the band. Collision among signals transmitted by mobiles, as well as the high powered housekeeping signals, from more than two systems would degrade service below acceptable quality. Location success rate will decrease as additional providers introduce additional signals on the air, resulting in significantly more retries and loss in accuracy for all providers. Attempts to offset this loss in performance with an increase in mobile unit power would escalate according to the "tragedy of the commons"⁵ and inhibit the introduction of new services such as portable low-powered location applications. Additionally, a third system could not use an adjacent wideband forward link segment as a contiguous

⁴ Teletrac's ex parte contained an error in the Emissions chart. Calibration transmitters (in the Location Sub-Segment) are identified as being limited to 3 seconds. As discussed above, duration should be limited to 50 ms every other second.

⁵See Teletrac Petition for Rulemaking, May 26, 1992 at 25-26.

segment, and would be significantly disadvantaged in terms of innovation.

The "first to construct and operate" policy would provide the appropriate incentive for commercial system deployment. By rewarding the first two systems in a market with protection, the Commission would deter speculators from obtaining licenses without the intent or capability to actually operate a system.⁶

In order to determine who is "first to construct and operate", this term must be defined. The inherent limits of the spectrum available require the Commission to set high standards for actual commercial deployment. Only proven, robust systems with actual paying customers should receive protection from later entrants; this protection in turn would encourage the investment needed to construct commercially viable systems.

Teletrac proposes that licensees seeking co-channel protection demonstrate that they cover at least 50% of a service area, with a position location accuracy of 300 ft., 90% reliability, and at least 1,500 paying mobile units. Under these conditions, no "construction period" or "commencement of operations" need be specified.

D. Service area should be defined as Basic Trading Areas (BTAs) in order to establish comparable service areas.

⁶ See also discussion by Professor Pickholtz regarding the incentives of wideband competitors in an open entry environment to create "dummy" corporations in order to get additional spectrum under and "equal sharing" approach. Pickholtz Analysis at 31.

Under the current interim rules, wideband LMS systems are licensed by particular transmitter sites that have been selected by a system operator. Service area contours are thus unique to each provider, which would not permit system comparisons.

Teletrac believes that BTAs provide a better basis than MSA/RSAs for LMS licensing because the coverage area customers seek for tracking and emergency services extend beyond city limits to the broader metropolitan area where people are likely to commute, conduct business, or routinely drive.⁷ Licenses already granted under the interim rules should be automatically converted to BTAs to prevent unnecessary paperwork and use of Commission and industry resources.

E. Voice communications should be permitted on a limited basis, only as ancillary to the position location function. That is, a subscriber to an emergency roadside service should be permitted to communicate the nature of an emergency (e.g., crime in progress, serious injury, automobile fire) to assure rapid response and efficient use of emergency resources. In order to prevent broader usage of this spectrum for voice communications, subscribers would have no access to voice capabilities other than between themselves and their service providers. This limited

⁷ As is the case with other services licensed according to prescribed service areas, issues regarding interference at boundary areas should be handled by cooperation and coordination between adjacent system operators.

exception would preserve the integrity of the Commission's general policy that the 902-928 MHz spectrum serve primarily location functions.⁸

III. Additional Issues Raised by Ex Parte Comments

A. Objections of Part 15 Users. Part 15 equipment manufacturers have filed ex partes reiterating concerns they have expressed about "new" communications being licensed in the 902-928 MHz band.⁹ Teletrac disputes this contention, as the NPRM would actually ratify existing services through permanent rules. No change in the legal status of Part 15 devices is necessary or appropriate.

As Teletrac has asserted in previous filings, LMS operators and Part 15 users have coexisted in the 902-928 MHz band without significant interference, and will continue to do so. LMS are designed to accept a certain degree of interference, and the low power, limited range of Part 15 devices are not likely to cause problems. Teletrac's system in particular utilizes numerous receive sites in each city, thus providing redundancy in case of temporary interference

⁸ See NPRM footnote 19, emphasizing that transmission of information not directly related to locating an object is permissible, but that such transmissions must be limited to those related to objects being monitored or located.

⁹ See Joint Letter from Part 15 manufacturers, users, and trade associations to Commissioners Quello, Barrett, and Duggan, dated November 2, 1993; Letter from Henry M. Rivera to Acting Secretary William F. Caton, January 13, 1994. Each of these letters object to the creation of "new" services which would include voice communications in addition to vehicle location monitoring. As described above, Teletrac's emergency voice application is currently authorized under the interim rules and would be an extremely limited part of its location services.

into a specific receive site.¹⁰ In isolated instances where Part 15 devices do cause interference to LMS systems, problems can often be resolved through power reductions or the use of directional antennas.

To enhance the stability of the Part 15 environment, Teletrac would support a definition for "harmful interference" to be included in the rules. A possible set of criteria would include maximum interference levels relative to ambient noise levels and a maximum duty cycle. Teletrac proposes the following language:

A Part 15 device will be considered a source of harmful interference if the signal level from that device exceeds the average interference and noise floor at an LMS receiver by more than 10 dB for more than 20% of the time over any 60 second period (10% if the signal exceeds the 10 dB limit at more than one LMS receiver).

In any event, Teletrac's new sharing scheme would further improve the environment for Part 15 devices. Because wideband LMS systems are likely to gravitate to the 902-912 MHz band where they will receive protection from narrowband system interference, Part 15 devices will have greater access to the remaining 16 MHz (and continue to be free to operate anywhere within the entire band on a noninterfering basis as they do now). Part 15 manufacturers can thus design devices to operate above 912 MHz with greater confidence about future usage of the band.

While Teletrac continues to believe concerns raised by the Part 15 community are misplaced, and that most Part 15

¹⁰See Teletrac NPRM Reply Comments at 44.

devices will not cause harmful interference to wideband systems, the new proposal should alleviate fears about coexistence in the 902-928 MHz spectrum.

B. Feasibility of Teletrac's Sharing Proposal. As pointed out by MobileVision in its ex parte filing, Teletrac's sharing proposal is a significant departure from its previous recommendations that wideband systems not share spectrum.¹¹ Teletrac's new proposal does not contradict its past technical analyses, but rather provides a compromise solution with the minimum rules necessary for successful commercial operation of two wideband LMS systems.

Teletrac has consistently maintained that uncontrolled sharing of spectrum would not be workable. Teletrac's position has not changed; rather, it has devised sharing rules that work by allowing sharing of the return link only, segregating forward link transmissions, and alternating housekeeping transmissions of co-channel systems.

Teletrac has maintained that two wideband LMS systems will interfere with one another if they attempt to share

¹¹ MobileVision ex parte at 5. MobileVision's comments regarding the alleged anticompetitive impact of Teletrac's proposal are inaccurate. In addition to the two wideband systems eligible for co-channel protection, additional wideband systems can provide services in the 902-912 MHz band on a noninterfering basis, and in the 912-928 MHz band on a co-primary basis. Furthermore, MobileVision's current investment in infrastructure in the upper frequencies can be protected through grandfathering or transitional rules.

both forward and return link sub-segments.¹² Under the current proposed scheme, each wideband LMS operator will share only return link spectrum. By limiting sharing to the return link, service degradation is minimized and will be statistically distributed in time and space. It is the mechanism in the receivers which takes advantage of processing gain that allows the return link to be shared. The processing gain achieved through spread spectrum techniques in wideband LMS systems protects mobile transmissions from interference (up to a certain limit). The loss in accuracy and number of retries needed on the return link will not be so great as to drive consumers off the system, assuming reasonable limitations on radiated power levels and duration of signals transmitted are adopted.¹³

Sharing of the forward link is not possible because of the significantly higher transmit power and lower propagation path loss compared to mobile unit signals. These two differences result in interference levels at receiver sites from fixed transmitters that require more

¹²See Pickholtz Analysis (Conclusions) at 45. Problems include loss of accuracy, holes in coverage, reduced capacity, and uncertainty leading to lowered consumer confidence. See Teletrac NPRM Comments at 28.

¹³SBMS Virginia Tech Report concludes that direct overlay of CDMA systems will be problematic if there are differences in system operating parameters. Virginia Tech Report at 6. This study assumed single receiver reverse link reception, with the expected near/far problems. Their conclusions are not applicable to Teletrac's proposal which takes into account the multiple receiver reverse link associated with wideband LMS systems.

than 30dB additional processing gain to overcome compared to interference levels from mobile units.¹⁴

Successful sharing between wideband LMS systems also depends upon the assignment of sufficient spectrum to sustain a minimum quality of service, including reliability and location accuracy, which are functions of system capacity. Teletrac's design, which permits two wideband operators each to utilize up to 8 MHz of contiguous spectrum, is superior to splitting a band into two separate assignment. If each wideband operator were assigned only 5 MHz each (or 4 MHz as proposed by SBMS),¹⁵ the combined capacity of their systems would be far less than half of that available under Teletrac's design. This is due to the relationship between bandwidth and capacity, i.e., doubling the bandwidth quadruples the capacity.¹⁶ Conversely, location and messaging capacity will decrease approximately as the square of the bandwidth decrease. Thus Teletrac's proposed overlay of the return link of two wideband systems results in significantly greater capacity (and performance) than band splitting would provide.

¹⁴See Teletrac NPRM Comments, Appendix 2, "Theoretical and Field Performance of Radiolocation Systems".

¹⁵SBMS Ex Parte dated February 7, 1994 at 2.

¹⁶Pickholtz Analysis at 21. SBMS's Virginia Tech Report, at 8, argues that the information carrying capacity of any system only increases linearly with bandwidth, but for LMS systems which employ simultaneous processing for location and messaging, an increase in the signal duration for location will result in the same increase to send the message contained therein.

As discussed, we believe our proposal offers the best solution to the issues created by the fierce competition for this spectrum which has developed over the life of this proceeding.

C. Benefits to Narrowband Systems. Teletrac has submitted extensive evidence demonstrating that wideband LMS systems cannot tolerate signals from narrowband systems such as those used in automatic vehicle identification ("AVI") systems.¹⁷ Recent ex parte filings from manufacturers of AVI equipment continue to support such separation.¹⁸ Given the need for separate bands, Teletrac's new sharing proposal, which goes from 10 MHz to 16 MHz for co-primary narrowband/wideband use, is much more favorable to narrowband systems. 16 MHz of contiguous spectrum provides more flexibility in the design and operation of narrowband systems than would the noncontiguous spectrum available in Teletrac's original proposal. Additionally, Teletrac continues to support grandfathering of existing narrowband systems where there are no interference problems.

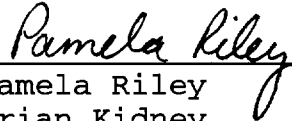
¹⁷See, e.g., Teletrac NPRM Reply Comments at 10.

¹⁸Letter from MFS/TI dated January 26, 1994; Letter from Hughes dated February 3, 1994.

IV. **Conclusion**

Teletrac filed its Petition requesting adopting of permanent rules in this band almost two years ago. No party is served by the continuing uncertainty regarding where various systems may operate, and under what terms and conditions. Teletrac respectfully urges adoption of its compromise proposal, which is technically feasible, and fair to current and future users of the band.

Respectfully submitted,



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March 15, 1994

CERTIFICATE OF SERVICE

I, Pamela Riley, do hereby certify on this 15th day of March, 1994, that I have served a copy of the foregoing Comments of PacTel Teletrac via first class mail or hand delivery to the parties on the service list attached.

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